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A COURSE OF STUDY

FROM PRIMARY SCHOOL TO UNIVERSITY.

[The following Report was read at the General Session of the National Educational Association, at Baltimore, July 12th, 1876, by WM. T. HARRIS, Chairman of a Committee appointed at the Annual Meeting in Detroit, to consider and report a Course of Study. This Report is to be made the subject of a special discussion at the next Annual Meeting.—ED.]

To the National Educational Association:

THE undersigned, appointed a committee to report a Course of Study for all grades of Schools, from the Primary School to the University, beg leave to submit herewith the results of their deliberations on this important theme.

At the outset, your Committee found it necessary to investigate a number of difficult questions, all of which had a practical bearing upon the definition of a Course of Study, its extent, and the relations of its several parts. In most instances these questions were suggested by real collisions shown to exist between the views held by the expounders of the various educational systems established in this country.

A brief review of these questions is essential as a preliminary introduction to the grounds which have influenced your committee in the recommendations which they venture to make.

1. The first question relates to the proper beginning of a course of study: at what age should the pupil be admitted to school? Upon this depends, in a large measure, the character of the studies and the temper of the discipline in the primary school. It is important here to consider the modifying effects of climate and the nature of parental training at home. In the Northern sections of the country, children may attend school one or two years earlier than in the Southern sections. A child may be safely placed in school at the age of five, or even less in the cooler climates, and assigned the ordinary tasks in reading and arithmetic at once, while in warm climates he must begin school at six or seven years of age, or if earlier, his tasks must be of a less severe character and not so prolonged.

To some of your committee the Kindergarten has commended itself as a desirable beginning of the primary course. At the age of five years, possibly at four, the child may be brought under its training. The principal objects aimed at in the Kindergarten course of instruction are—(1.) Skill in the recognition and production of forms. The hand and eye are disciplined in the most effective manner by the several occupations of cutting out shapes in paper, weaving patterns in different colors, perforating card-board and working pictures in colored threads, construction of geometrical and other figures by means of sticks and softened peas, modelling of designs in clay, ruling paper, and drawing symmetrical figures. (2.) The theoretical knowledge of form and number, is trained by the use of blocks representing the elementary geometrical solids; counting, the elementary rules of arithmetic, the use of fractions, are taught by means of these blocks. (3.) Besides this, the child is taught valuable lessons in manners. He eats his lunch at the table spread in a proper manner, and learns neatness, cleanliness and the conventional etiquette

that marks polite behavior at meals. (4.) In the games which are played, the imagination is exercised in a lively manner, and the healthful training of the body is secured. The session of the Kindergarten usually lasts for about three hours per day, and may continue for one or two or three years according to the age of the pupil upon entrance. It is to be remarked that the element of play is not so prominent a characteristic of the Kindergarten as is claimed by some of its advocates. Moreover, the nurture of the child's individuality and originality of character, which is obtained in play, is not to be expected from the play that is permitted in the Kindergarten, so much as in the untrammelled exercise of his faculties when outside of the school-room. Play involves a negative exercise of the will in caprice and destructiveness that is essential, no doubt, to the development of the feeling of independence and original power which forms the basis of character. But the school must always direct the pupil's efforts into special rational channels of activity, and hence act as a restraining influence upon the untamed will. The Kindergarten restrains, though in the gentlest manner possible. It furnishes a training nearest approaching that of the family; and is the proper transition from family to school. A year spent in cultivating manual skill, and in the acquirement of a familiar knowledge of geometrical form and numerical computation, as well as a training in polite habits and usages at so early an age, must be a powerful influence in molding the future life of the child.

2. Where the Kindergarten does not precede the ordinary course of primary instruction, the first studies of the course are reading, writing and arithmetic.

The second difficult question that met your committee in their investigation was to determine the precise value of these and other elementary studies both as regards discipline of

mind obtained in their acquirement, and their usefulness to the individual in gaining further knowledge. It was necessary to compare one branch of study with another. While some educational writers contend that the art of drawing, or oral lessons in natural science are of more real importance than reading and writing, or arithmetic, others contend that the latter studies are of a fundamental character, altogether unique and not to be compared with the former for the reason that these studies (reading and arithmetic) are of universal use and value, while such studies as drawing and the natural sciences are special in their character. The arts of reading and writing enable their possessor to participate in the treasured wisdom of the race. Without them he can gain knowledge only through his own senses and the oral tradition of his companions. By the aid of reading and writing he can avail himself of the senses of all mankind in all ages of the world and transmit his own contribution to the race in turn. By arithmetic he is able to measure the quantity of the world about him, at least so far as he can reduce it to number. Deprive man of the power of counting and calculating and the world of things recedes into a vague and uncertain relation to him so that his power over it diminishes to zero. With numerical calculation he can divide and conquer it—he can rule matter by spiritual might; without this art his relation to the world is that of the savage to his fetish.

In whatever form this question has been viewed by your committee, the paramount value of reading, writing and arithmetic over all other branches in the course of study has been manifest.

But this has not fully decided the question. The most useful studies do not of necessity altogether exclude less useful studies.

3. Here, accordingly, your committee met another difficulty,

to-wit: how to decide the amount of prominence to be given to industrial branches in comparison with those chiefly productive of theoretical culture.

That which seems to lie nearest to the realm of usefulness to the individual is his special trade or vocation. His culture-studies are not so directly useful, but are useful at more points in his life and for a greater period of time. In late years we have seen the whole course of study challenged. The primary school has been called upon to fit the pupil for the actual demands of life. The college and university have been asked to dispense with certain of their disciplinary studies and adopt others of greater immediate usefulness. Less Latin and Greek and more Science of Nature and Man, has been the demand. The Course of Study has received great modifications; the number of elective branches has been increased. Still the proper adjustment between culture-studies and practical studies does not seem to have been found. Now that education, as an element of national strength, has excited so much attention and become the object of so frequent legislation, we are the more perplexed by this problem. Indeed there are many problems here.

4. The question of public and private schools meets us first. On the one hand it is contended in the interest of productive industry, that the public schools, being for the masses who are destined to fill the ranks of common laborers, should give a semi-technical education, and avoid purely disciplinary studies. The latter should be reserved (it is thought) for academies and preparatory schools founded by private enterprise and open to such of the community as can afford to patronize them. This means a division in the course of study —one branch of it tending towards the arts and trades—the education of the laboring classes; the other branch tending towards high culture—"a liberal education," as it is called.

This important question, therefore, met your committee in this shape: Is the best course of study for the future common laborer, a part or portion of the longer course of study designed to educate the professional man? Is the complete course of study the same for culture and business and the professions, so that whatever section of it be cut off from the beginning, furnishes the best course up to that point, whether regarded as preparatory to a continuation of the course of study, or as a completed course fitting one for business? To settle this point it was essential to consider in detail the nature and effects of such differences in the course of study as had come to exist in our educational systems, and especially the tendency to separate the preparatory course for colleges and universities from that pursued in the common schools.

The course of study as originally planned for our colleges was a continuation of that in the so-called "Grammar School" in which Latin grammar was the most important branch of the curriculum. The common school course was very meagre, and that of the grammar school and college was well enough as a continuation of it. At that time very little development had taken place in the sciences of nature and man; English literature had not yet become a great power among the people; the printed page in the form of the newspaper and magazine had not yet opened to the individual the great possibilities of continuing his theoretic education. What was then a "liberal education" is inferior to a common education now. Although higher education demands only the same disciplinary studies as preparatory to it, that it did formerly, merely increasing the amount, and has recognized the modern growth of literature and science and history by additions to the end of its course, in the common school so much has been added to the disciplinary studies as to completely change the course. The branches which initiate the pupil into the sciences of

man and nature are better and better provided for year by year. The curriculum is continually modified so as to adapt it more fully to the wants of the individual in this epoch. But the higher education has yielded far less to the demands of the age. It has succeeded in repelling the collateral and information-giving studies from its preparatory course, and it admits them only in the form of a supplement at the close of the course.*

* The Forty-Eighth annual report of the President of Harvard College announced certain changes in the requirements for admission to that university which indicated very clearly a perception of the difficulty herein described. A better preparation in English literature, natural science and modern languages (French or German) was required. Upon this the report remarks as follows:

"In all changes in the preparatory course of study which have been here set forth, the single aim of the Faculty has been to make that course correspond more nearly with the best possible course of study for young men, up to an average age of eighteen, who propose to pursue non-professional studies for four years more. As the learning given in American colleges has been predominantly classical and mathematical, it is not surprising that the proficiency of a candidate in Classics and in Mathematics has been the point chiefly considered in examinations for admission. That teachers and pupils in preparatory schools should direct their efforts mainly to meeting these specific demands of the colleges, and should subordinate the intrinsic importance of studies to their serviceableness in securing admission to college, is the only result that could be expected. Neither teacher nor pupil could be much blamed, for instance, for practically setting the writing of good Latin above the writing of good English. It is plain that the only remedy for this grave evil is for the colleges to show by the nature of their admission examinations that they will not accept the rudiments of *scholarship* as amends for deficiencies in the rudiments of *education*. The colleges, as the representatives of the value of the study of the Classics, should be especially careful not to give plausibility by any act or neglect of theirs to the groundless assumption that the discipline of mind secured by the preliminary classical training must be purchased by the sacrifice of some knowledge which a well-educated young man of eighteen ought to possess. Co-operation on the part of the leading colleges is much needed in enforcing upon teachers, and in enabling them to enforce upon their pupils, the necessity of thorough training in all the elements of a sound education. As soon as those colleges unite in demanding of candidates for admission a thoroughly good training in English no less than in classical subjects, the schools which feed the colleges will in turn be able to exact from the lower schools an efficiency which they now greatly lack. The service which American colleges could thus indirectly render to American education it is difficult to overestimate. Were a good degree of proficiency *in a well-constructed course of English studies* strictly enforced as a condition of admission into our leading colleges, the quality of education received by all pupils in all schools directly or remotely affected by such action would be sensibly improved. Hitherto a too exclusive concern for proper preliminary training in the Classics and Mathematics has cut off the higher institutions for education in this country from a part of that influence upon the lower which it is both their interest and their duty to exercise."

The course of the common school tends to take the pupil through the elements of the collateral studies before his preparation for college, while the course of the college and its special feeders, the academies and classical schools, does not reach those studies until after five to seven years' apprenticeship in the purely disciplinary studies is completed.

This difference appears most marked in the course of the public high school, as contrasted with that of the special preparatory schools. In the district school are taught reading, writing, arithmetic, geography, grammar and history of the United States. In the course of study in the public high school, we find Latin and Greek, French and German, algebra, geometry, natural philosophy, physical geography, physiology, universal history, English literature and rhetorical work. But a preparation for college usually omits all except the Latin, Greek, and mathematics. Hence the public high school is obliged to provide for a classical course and a general course, if it would continue the common school course and at the same time prepare its pupils for college. The influence of higher education upon the lower is to force the latter to drop its collateral and information-giving studies.

Meanwhile the demand of the age upon the college to curtail its disciplinary and culture studies, and to give more prominence to the natural sciences is met only by the increase of these branches in the latter part of the course, as well as by the establishment of scientific schools separate from the regular philosophical course; when these separate schools require as a condition of admission to them the completion of the regular college course, they do not fulfil in a direct manner the popular demand; when they admit pupils without such preparation, they omit the culture and discipline which they claim to be essential to success in the pursuit of higher science.

5. In view of these facts your committee proceed next to consider the question of classical culture. Are Latin and Greek essential to a course of study that shall give thorough discipline to the powers of the mind? What special advantage to culture is derived from the study of Latin and Greek over that derived from the study of Modern Languages—say French and German? That these ancient languages have no advantage as regards their form or capability of expression—one may convince himself by comparison. But when it is remembered that English-speaking peoples derive from a Teutonic source only those words expressive of special and familiar relations and ideas, while for all the fine shades of thought and generalization they resort to the Latin and Greek vocabulary, it will easily be seen how important is a direct knowledge of those tongues to us if we would understand readily the language of thought, and express with ease the results of reflection and generalization.

The scientific method prevailing in our time tells us that to know a subject properly we must study it in its history. We must be acquainted with its embryology and growth. In this insight we have also a clue to the nature of the much prized disciplinary value of classic study. The classics of a people include the earlier writings belonging to the period of the evolution of its civilization. A study of its classics places one in possession of the seeds and elementary phases which have expanded and grown into its later life. The civilization not only of the Anglo-Saxon people, but of the Romanic, Teutonic, Sclavonic and Celtic peoples of Europe is a Roman and Greek civilization. Greece and Rome originated the stock of ideas that form the basis of our institutions. The Greek mind explored the domain of theoretic and æsthetic culture, and science draws its categories to-day from the Greek language; while art points to Greek literature and Greek sculpture and

architecture for perfect models. What culture we have in these directions cannot be well acquired by the individual nor fully comprehended by him without recourse to its original fountains. Rome furnished the organizing forms of our civilization; and our jurisprudence and legislation still pronounce their edicts in Roman words; and the form of our institutions in which we live and move and have our being as a civil community—as a State, a municipality, a corporation, a free citizen endowed with rights—is Roman. To know ourselves, to realize our past history, and to make alive within ourselves the consciousness of the development of our civilization, we must for a period come into close contact with the literature in which Greece and Rome portrayed their national life. Language is the clothing of the ideas of a people, a garb woven of poetic phantasy and prose reflection. In it we reach the germinal cell-growth of the ideas of a people. In this respect the study of Latin and Greek furnishes to a European or an American a far higher means of culture than does any modern language. No one modern language is an embryonic type of another, nor does its literature portray the embryonic form of the civilization of another people, even though it may be an "arrested development" of some type of civilization. To study the embryology of the butterfly, we must begin with the caterpillar and not with the house-fly. So to understand the frog we must study the tadpole rather than the turtle. French and German have their own evolution and their own embryology.

6. Pursuing this thought we come to inquire why it is that language in general should furnish so large a portion of the course of study. The spirit of protest demands: "why not *things* rather than *words*?" And yet education goes on dealing with *words*! If thought—scientific thought—be the end of culture and education, it is not strange after all that so much is

made of the word that expresses it. Things are only transitory phases of processes in nature—the temporary equilibria in the great movement of forces. Science seizes the eternal laws or forms of the process itself and thus deals with what has more validity than the mere things. Words express not things alone but also forces—processes. The verification of the word is therefore not through things alone but through the synthetic activity of thought. Words stand for more than mere things.

Looked at as an object of knowledge the world is two-fold; (a) the world of man—including his realizations in art and literature, in his political and social institutions, in his science and history; (b) the world of nature including the inorganic aspect, and the organic one of plant and animal. In the study of language we find the three-fold world of man as theoretical, practical and æsthetic. If we go so far as to call the world of man the most important of studies for man, we shall certainly call language the most important study of the course —the one which gives most clearness of insight to the mind and the most discipline to its powers. But while the perfection of man is the object and end of civilization and consequently of all other culture and education, on the other hand nature is the instrumentality by which this end is achieved. To the savage man nature is master and tyrant; to civilized man nature is servant and thrall. To omit the science of nature from any course of study, is to do wrong to the supremacy which man holds by reason of his empire over nature. To slight the science of language in a course of study, is to insult the object of all study itself.

7. The final difficulty which your committee encountered in their investigation is the one of the natural and proper order of development of the topics of the course of study in the mind itself. Such questions were met as these: "Why not get dis-

cipline of mind first before taking up collateral branches, such as the natural sciences, the national literature and history?" "These topics involve the highest reach of the mind to be understood properly." Or the counter position: "Why are not the natural sciences, history and literature as valuable discipline studies as Latin, Greek and mathematics? and if so, why not begin with them in a course of study?"

Upon consideration of this question of the order of topics, your committee are of opinion that each one of the several fields of the objective world of man and nature should be represented at each point in the course of study. Nature in its organic and inorganic forms, mind in its theoretical, practical and æsthetic forms. To those who object to collateral and information studies side by side with the discipline studies it may be said that they lay emphasis on the inorganic phase of nature by the exclusive study of mathematics and physics and on the theoretical phase of mind to the exclusion of the practical and æsthetic phases by the too exclusive study of grammatical forms and constructions.

To those who object to the study of topics that are too difficult to be understood in the most comprehensive sense, until the close of one's disciplinary course it is sufficient to point out the fact that every subject has its abstruse side and that no phase of natural or of human history can be completely comprehended except in and through the world itself. Even the disciplinary studies themselves treat of topics that are not fully explicable until one has mastered the other studies.

The child seizes whatever subject he studies more vaguely than the adult. His active phantasy is his chief organ. Hence the descriptive phases of science can and should be learned early. In secondary education the classifications and relations come properly to be considered—reflection is then

the chief mental activity. In the highest phase of education objects are studied as organic wholes—each individual is seen through the perspective of its history.

Without previous familiar acquaintance with a subject obtained by studying its first or descriptive phases, one gets very little insight into the philosophy of it, even though he listens to the exposition of a Huxley or Agassiz.

That mathematics and the classic languages are justly regarded as disciplinary studies in a sense that will not apply to the other studies, is pretty evident from the reasons already given. Discipline is the process by which the will is purified from the sway of appetite and caprice. In his infantile state, as child or savage, man's will is implicit—not separate from his desires or appetites. A child or savage is a creature of impulse. To become rational he must substitute principle for caprice; moral forms for impulses. The training requisite to emancipate the will and elevate it from the stage of impulse to that of moral activity, must needs possess the following essential characteristics: (a) It must occupy the pupil with what is remote from the interests of his every-day life; self-alienation is necessary to self-knowledge; in order to see our own dwelling in its relations to surrounding objects it is necessary to go out of it and stand at some distance. The atmosphere of the classic people of Greece and Rome furnishes the broad contrast to our every-day life which enables us to discriminate sharply the motives which unite to form our impulses. (b) Inasmuch as the civilization of those classic peoples is the embryonic form of our own, as has already been pointed out, the student of the classics has the advantage of seeing the universal, or regulative, forms of his life (the laws, institutions, and usages which define his status as a human being,) in their special forms and applications. He learns more readily the universal by studying it, at first as a typi-

cal instance. The invisible cloak of forms wrapped about his life—invisible because of its general or abstract nature—thus becomes visible to him and he acquires the ability to separate his deed from his impulse by the insertion of general motives. Reflection takes the place of instinct and caprice. By studying that which has no direct and obvious relation to his immediate interests but which is allied to the general forms of his rational activity, the youth obtains breadth and perspective of practical insight. The disciplined mind makes its purpose a general one and does not allow caprice (likes and dislikes, weariness of the body, curiosity, love of ease or amusement,) to hold sway. Mathematics as the science of the general relations of time and space—the conditions under which the existence of nature is possible, has the same relation to man's physical existence as classic study has to his humane culture.

This mental discipline is not a matter of perseverance and industry simply, so that whoever studies any subject thoroughly will get the same amount of discipline as another, but the object studied must stand related to the student's general and rational forms of life and thought.

Assuming the division already indicated, our course of study will fall under five sub-divisions, each of which must be represented at every stage of progress. A careful survey of this ideal standard discovers the fact that with the exception of the divergence already mentioned between preparatory schools and the public high schools, there is a close conformity to the educational system generally adopted in the country. Were the college or university to require for admission a knowledge of the elements of natural philosophy and physical geography (the former a compend of physics and the latter of natural history), universal history, and English literature, and slightly less of Latin and Greek, it would re-

move the necessity of two courses of study in the high school.

The five sub-divisions are:

I. Inorganic Nature, treated in (a) mathematics, the science of the general form of nature as existing in time and space, and hence as quantitative; (b) Physics, molar and molecular, including the science of the contents of nature in their quantitative aspect.

II. Organic Nature or Cyclic Processes, treated in Natural History and in all natural sciences which have for their object a cyclical process, whether that of life or not; hence, astronomy, meteorology, geology, botany and zoology, and kindred sciences.

III. Theoretical Man or Intellect, treated indirectly in (a) Philology or the science of the instrument invented for the reception, preservation and communication of thought; treated directly in (b) Philosophy which investigates the universal and necessary conditions of existence or the forms of the mind that appear in logic, psychology, ontology, and other spheres more concrete. The study of grammar is the propædeutic to this field.

IV. Practical Man or Will treated in (a) Civil History, which portrays man's progress in realizing forms of freedom by means of political organization; (b) Social and Political Science which investigates the evolution of institutions of civil society and their logical basis.

V. Æsthetical Man, or Phantasy, as developed in the Fine Arts, and especially in Literature as the symbolic portrayal of man to himself, the collisions of his real world with his ideal, and the reconciliation of the two.

In mapping out the provinces which shall be investigated, only a small portion of the work of preparing a course of study has been accomplished. It remains to select those branches of study which are to be pursued continuously from

year to year throughout the course, and likewise to decide the amount of time to be given to the other branches, as well as their exact order in the course. In this difficult and delicate part of the task it becomes evident that within certain limits very much freedom may be allowed to the teacher and pupil, and in fact must be allowed. It is necessary to have each one of the five departments well represented in the course. But a choice may be made, for example, in the department of the study of organic nature, between botany, zoology, physiology, and geology, each one of these studies being a fair type of the rest as regards effect on the mind in culture or discipline. It must not be forgotten moreover that the age of pupils and the amount and quality of previous preparation will determine whether the course shall be very full or whether it shall embrace only a few of the representative branches; whether the special branches shall be continued for half a year each or for a whole year.

In the more important branches there should be no option left to the pupil in the high school, for example, all should be required to take Latin, Algebra and Geometry, Universal History, Constitution of the United States, History of English Literature, Rhetoricals, Natural Philosophy and Physical Geography.

Omitting the phase of physical training, except in so far as the art of drawing secures it in the form of a culture of the hand and eye—a general propædeutic of manual skill—and not including the ground covered by the Kindergarten which would precede, or that of the special trades or professions which would succeed this general course, your committee present the following tabulated scheme for a general course of study from primary school to university.

DISTRICT OR COMMON SCHOOL.

TOPICS RELATING TO NATURE.

Inorganic.—Arithmetic, Oral Lessons in Natural Philosophy.

Organic or Cyclic.—Geography, Oral Lessons in Natural History.

TOPICS RELATING TO MAN; OR "THE HUMANITIES."

Theoretical (*Intellect*).—Grammar, (Reading, Writing, Parsing and Analyzing).

Practical (*Will*).—History. (Of United States.)

Æsthetical (*Feeling and Phantasy.*)—Reading Selections from English and American Literature. Drawing.

HIGH SCHOOL OR PREPARATORY SCHOOL.

TOPICS RELATING TO NATURE.

Inorganic. — Algebra, Geometry, Plane Trigonometry, Analytical Geometry, Natural Philosophy, Chemistry.

Organic or Cyclic.—Physical Geography. Astronomy (Descriptive), Botany or Zoology, Physiology.

TOPICS RELATING TO MAN; OR "THE HUMANITIES."

Theoretical (*Intellect*). — Latin, Greek, French or German, Mental and Moral Philosophy.

Practical (*Will*).—History (Universal), Constitution of the United States.

Æsthetical (*Feeling and Phantasy*).—History of English Literature, Shakespeare or some standard author, (one or more whole works read). Rhetoricals (Declamation and Composition). Drawing.

COLLEGE OR UNIVERSITY.

TOPICS RELATING TO NATURE.

Inorganic.—Analytical Geometry, Spherical Trigonometry, Differential and Integral Calculus, Physics, Chemistry, Astronomy, (Etc., Elective.)

Organic or Cyclic.—Anatomy and Physiology, Botany, Zoology, Meteorology, Geology, Ethnology, (Etc., Elective).

TOPICS RELATING TO MAN; OR "THE HUMANITIES."

Theoretical (*Intellect*).—Latin, Greek, French or German, Comparative Philology, Logic, History of Philosophy, Plato or Aristotle, Kant or Hegel, (or a representative of ancient philosophy and also one of modern philosophy).

Practical (*Will*).—Philosophy of History, Political Economy and Sociology, Civil and Common Law, Constitutional History, Natural Theology and Philosophy of Religion.

Æsthetical (*Feeling and Phantasy*).—Philosophy of Art, History of Literature, Rhetoric. The Great Masters compared in some of their greatest works: Homer, Sophocles, Dante, Shakespeare, Goethe, Phidias, Praxiteles, Skopas, Michael Angelo, Raphael, Mozart, Beethoven, &c.

MAKARIA.

A PLAY IN FIVE ACTS.

S. STERNE.

Dramatis Personæ.

DEMOPHOON—*King of Athens, son of Theseus.*
JOLAUS—*Nephew of Hercules, and Leader of the Heraclides.*
ADRASTUS—*Son of Jolaus's friend, and under his protection.*
ALKMENE—*Mother of Hercules.*
MAKARIA—*Daughter of Hercules.*
THE HERACLIDES—*His Sons.*
KROPEUS—*Herald to King Eurystheus.*
MILOS—*An Old Athenian.*
THE PRIESTESS, *at Delphi.*
Messengers, Women, Citizens of Athens, &c.

ACT I.

SCENE I. *A Marketplace in Athens. On one side an altar to Jupiter.* ***Enter*** JOLAUS *and* ADRASTUS, *with a band of seven youths and boys of different ages, some of them bearing green branches in their hands.*

Jol. Praised be the kind, protecting gods, whose mercy
After our weary march of many days,
Led safe our steps at last to this blest city!

One of the Her's. And pray what city is this, Father Jolaus?
It seems most great and fair!

Jol. Ah, well it may!
'Tis Athens, child!

Adras. Athens, thou Queen of earth,
Thou fruitful Mother of so many heroes,
Cradle of thousand great, immortal deeds,
I greet thee from my heart!—that dreamed of thee,

Long ere these eyes beheld thee!

2d Her. Father Jolaus,
Is this not, then, the end of all our wanderings,
That you so long have sighed for?

3d Her. Come, my Father,
Come haste and let us in! What pause you here?
To find some comfort with the kindly townsmen,
We are athirst and weary!

4th Her. And the heat
Strikes blazing back from these unsheltered stones,—
'Twere well, methinks, to enter.

Jol. Nay, not so!
Check your impatience yet a little time!
It does become not us, who seek protection
And refuge here, to overrun the city
Like a bold band of conquering foes! Rest here,
Beneath this altar to Almighty Jove,—
What better shelter than this sacred spot
Could all the earth afford us!—and wait calmly,
In quiet modesty, till we be welcomed,
Nay, better say, e'en but admitted here!
Till it may please whoever rules the town,
To hear our tale, and mayhap grant our prayers! (Sits down.)
Come, sons, sit here with me! (They group themselves round him.)
And those of you
Who plucked green branches by the roadside, wherewith
To shield yourselves from the hot noon-day sun,
If yet the leaves be fresh enough, weave them
To chaplets now, to twine about your heads,
As it is fitting they who plead should wear. (They do so.)

Adras. Lean on my shoulder here, dear Father Jolaus,
I yet feel no fatigue.

Jol. Aye, I am weary,
And what small strength is left in my old limbs,
Too easily drained!

(A few citizens have gathered, and gaze at the strangers from the distance.)

Adras. Look you those men, my Father,
How they gaze on us!

Jol. A few envious idlers,—
Of better citizens the Mart is empty,
At this late hour of noon.

(Enter *Kropeus*, who gazes around for a moment, then perceives the group, and comes rapidly towards them.)

2d Her. Look, Father Jolaus, who is this comes here,
So swiftly towards us! His loud step is bold,
His eye gleams on us with no kindly light!

Adras. A Herald, by his garb!

Krop. Ho, ho, my birds,
My cunning birds, that fancied they'd escaped me,
Is't here I find you, and so soon!—arrived,
As your appearance hot and worn, betrays,
A javelin's throw scarce, in advance of me!
Is't here you'd make your comfortable nest,
And fancy it were safe! Nay, but you'll find
Yourselves most grievously deceived, I swear,
For now my hand is on you, and you're mine!
—Ah, well may pallid terror shake your limbs,
And blanch your cheeks!—For know that I am Kropeus,
Herald to King Eurystheus of Argos,
Who, you well know, has sworn death and destruction
Unto you all! (*Her's* cry out.)

Jol. Hush!—hold your peace, good sons,
Leave me to deal with him!

Adras. Eurystheus,
Our old, implacable, most deadly foe,
Pursuing us with hatred unappeased
Even here!

Krop. And in his mighty name I bid you,
Rise up and follow me this hour to Argos,
There to receive what justice shall mete out!
—Come, come, old man, with all your flock of fledglings,—
Delay no longer! I'm in haste!

Jol. Nay, hold,
Not so, bold Herald! By this sacred altar
To Jove, the Immortal Father, consecrate,
Who ne'er abandons those seek refuge with him,

I claim protection here from your rude insolence,
And your proud Master's wrath!—claimed it, e'en were
This not a land of freedom where we bide!

Krop. Ho, freedom and protection, in good truth!
Think you that he rules here, whoe'er he be,
Were such a fool to peril crown and life
Setting his face against my Master's will,
Defying his just ire?—from a good friend
And great ally, turning him thus into
A powerful foe,—for the dear privilege
Of shielding from their long-due penalty,
A band of vagrant fugitives like you,
Claimed by no country, by no city harbored?—
Nay, by great heaven!—For know I come alone not,
Upon my errand, but as a precursor
To them that shall enforce all my demands.
—An army of ten thousand goodly men
Treads close upon my heels,—lies now encamped
But two leagues from the city gates!

The Her's. O Jove!
An army, but two leagues!—of fell Eurystheus!—
Ten thousand!—O most kindly gods, have mercy!
We're lost, sweet heaven!

(At these cries citizens come streaming to the place from every quarter, and gather round the fugitives. Exclamations of citizens.)

1st Cit. Ho, ho, what noise is this,
What shouts and cries and woeful lamentations
Rend all the air?

2d Cit. Aye, who are all those strangers!
—What may that old man be, gray-haired?

3d Cit. And they,
The slender youths and boys that cling about him,
Some with green chaplets in their golden locks!

4th Cit. And he the tall, dark youth who stands apart!

5th Cit. Who's the strange Herald there,—What would he here?

6th Cit. Hush, hush, let's hear, good neighbors!

Krop. (Approaching *Jol.*) Come, I say!
Enough of this, old man, and overmuch!

Haste now and follow me, without—

Adras. (Stepping between them.) Stand off!
Lay not a hand on him, or by the gods,
You go not hence alive to tell the tale!

Krop. And who are you, that thus most insolently—

Jol. (Addressing the *Cit's.*) Ye men of Athens and good citizens,
Friends, would that I might call ye! will ye suffer
That we, defenceless fugitives, who seek
A shelter on your hospitable shores,
Protection with your mercy and the gods,
E'en in your very sight be torn away
From this most sacred spot of refuge,—here
Be to our cruel foes delivered up?—
Permit the leafy crowns these wear, to be
Dishonored, and therewith dishonor bring
Not on yourselves alone, and your fair city,
But on the very gods themselves who guard you?

(Exclamations of Citizens.)

1st Cit. No, no—well said, Old Man!

2d Cit. But pray who are you?

3d Cit. And who these others with you?

Jol. Will you give
To sure and swift destruction all these youths,
The noble sons of an immortal Sire?
For know their Father, the most godly mortal
That ever walked the earth, was Hercules! (Pointing to *Adras.*)
Father to all but him.

3d Cit. What, Hercules!
Great Hercules, whose Mother too, and daughter—

5th Cit. Ho Hercules, and these then are his sons!

7th Cit. Fair, comely lads!

4th Cit. Away!—Stand off, bold Herald!
By his undying name you shall not have them,
Whoe'er you be and who may be your Master!

2d Cit. Nay, by the gods, the King would never suffer it!

3d Cit. He gave protection to his other kin!

4th Cit. Away, we say!—

Krop. And pray who is your King,

Of whom you prate so loudly?

6th Cit. A most just,
Most wise and merciful ruler, Theseus' son!

Jol. O blessed once more, thrice blessed be the gods,
That hither led our steps!—Now may we hope!
For the great Theseus' son must surely be
Of noble spirit and magnanimous!

4th Cit. But who are you, Old Man, and here, this Herald,
Who holds so insolent speech to you, who's he?

Jol. I am,—he is,—Nay but good friends I pray you,
Haste rather one of you to call your King,
And let me pour my tale into his ear!

4th Cit. Aye, aye!—Run! Ho, but look you, here he comes!

6th Cit. Ay, there he is himself!

5th Cit. Give way there, neighbors!

1st Cit. Room for the King!—

(Enter *Demophoon* with a few attendants.)

Dem. What means this noisy throng
Here in the Mart at this unwonted hour?

Krop. (Stepping forward.)
Now shall we soon see whose will be the victory!
—It means, O King, the claims of right and justice
Which I demand and these refuse!—I'm Kropeus,
Herald unto the mighty King Eurystheus
Who rules in Argos, and supported by
A powerful host that follows close upon me,
Have come to claim and take these fugitives,
Argivians too, and subject to my Master,
Who here would seek escape from him, and their
Just fate, too long delayed.—Ere this they have
Traversed all Greece, expelled from every city,
Driven out from land to land, for no one ventured
To brave my Master's wrath, receiving them,
And surely you, King, will not prove alone
So most foolhardy to take up their cause!

Dem. By heaven, your boldness, Herald, is as great
As your persuasion feeble!—For no other
Would shelter them, I too must cast them off!

The very argument that you employ
To turn me from them, is methinks what pleads
Most loudly in their favor!

Krop. It is justice,
But simple justice at your hands, great King,
That I demand!

Dem. How can I mete out justice,
Or but decide where lie the claims of justice,
Ere I shall hear both parties! (To Jol.) Speak you now,
Who are, 'twould seem, the leader of this band,—
What may you say to help your cause?—

Jol. (Advancing and bowing before *Dem.*) O King,
Great Theseus' Son! surely the secret hope
That led and drew us here, that made us glad
When first we planted here our weary feet,
Shall not prove vain!—For this is freedom's soil
Where speech is so unfettered, where do reign
Counsels so just and wise and moderate!—
If it be justice he demands, O King,
'Tis in sweet Mercy's gentle name I sue,
Though when you hear my story, you shall judge
How little right he have to call on justice!
The band of youths that you see here, are sons
To the immortal Hecrules!

Dem. (Aside.) In truth
I was not then deceived,—Makaria's brothers!

Jol. And I their guide and guardian am old Jolaus,
Nephew to Hercules, and long-tried friend,
Who since he was translated to Olympus,
Have stood a father to his orphaned children.
So we have traveled through the world long years,
Our aim and purpose sometime to find means
Wherewith to gain possession of the goodly
Inheritance, their Father conquered for them,
That has been long withheld by the deep cunning
Of wily, powerful foes.—Yet did we see
All feeble effort ever foiled and baffled
By the fierce hatred of Eurystheus

The Argivian King, the same at whose command,
And much against his will, compelled thereto
By Jove himself, great Hercules performed
The matchless deeds wherewith the world yet rings.
Eurystheus, who when he noted how
His kinsman's fame so far outshone his own,
Pursued him with undying vengeance, now
That on himself he may no longer wreak it,
Transferring it to these, his innocent sons,
Whose only crime is their illustrious birth,—
Bent upon their destruction.—Thus, O King!
As truly said the Herald, have we sped
Sad pilgrims from one city to the other,
Scarce resting twice our heads on the same pillow,
Driven ever out by him, or fear of him,
Who is our deadliest enemy. And thus
Come here at last, O King, to your fair city,
Fancying, hoping, trusting, well nigh sure,
Though ignorant great Theseus' son ruled here,
That here upon this generous soil at last
We should find refuge. O Demophoon,
Crush not within us that blind confidence,
You, our last hope!—For if you cast us off,
Despair and ruin stare us in the face;
Must prove our daily portion!—We shall be
Like miserable, shipwrecked mariners,
Who after weary battling with the waves
Have gained a shore at last they fancy safe,
And suddenly are after all engulfed
By the fierce, hungry sea, that sweeps them off
The rock they vainly cling to!—O close not
Your ears unto the tender voice of pity,
That I perceive speaks loudly in your heart,
And gazes through your eyes!—(Kneels and clasps *Dem's.* Knees.)
And if O King!
The claims of gratitude have power to move you,
Call to your mind that it was Hercules,
The Father of these youths, who did descend

To Pluto's fearful realm, and burst the bonds
That bound your father there, his noble friend,
The immortal Theseus,—who delivered him
From the dark terrors of the world of shadows,
And brought him back to the glad light of day!

Dem. Rise up, Jolaus, rise, my good friend! It is
Not meet that venerable age should kneel
To any but the gods!—Rise and take comfort! (*Jol.* rises.)
You have said well!—In truth I shall not suffer
The generous hope you placed in me prove vain,
The confidence you built on me fall flat.
Even did your ills and undeserved misfortunes,
Your gray hair Jolaus, and their innocent youth,
Appeal so strongly not to me as well nigh
To move me of themselves to grant your prayer,
There are two causes so imperative,
They would permit not I refused you.—Here
This hallowed spot where you have made your stand,
This altar sacred to Almighty Jove,
The guardian and protector of the unhappy,
Who could not see such prayer made in his name
Denied without offence;—and then as you
Have said, the priceless benefits conferred
By matchless Hercules upon my father,
That ever borne in grateful recollection,
Must ever bind me unto him and his!
(Aside.) And there's yet other reasons, friend, but that
It is not needful ye should know! (Aloud.) The realm
Would be no longer worthy to be called
A land of freedom and of generous virtue,
Where the immortal gods are duly honored,
Did I reject you and command you go,—
Nay, I receive you,—stay! I bid you welcome!—

(*Her's* utter exclamations of joy, the Cit's mingling their voices.)

Jol. Praised be the gods, and thou Demophoon!

Krop. This then is your conclusion, King?

Dem. It is,
You've heard me speak it!—And now haste, I pray you,

To so report unto your loud-mouthed master!

Krop. I will, by heaven, and this last insult too!
I go, proud King, and when I come again,
'Twill be with the great host that lies even now
Close to your city gates, and speedily—

Dem. Off!—Away
With you and your bold master to the Hades!
I fear nor you nor him nor all his army!—
Greet him for me, and ask him in my name,
If in his kingdom he could find for Herald,
No better man and one of smoother tongue
Than the one sent me last! (Exit *Krop.*)

(The *Her's* press about *Dem.* and seize his hands with loud exclamations of gratitude.)

2nd Her. O generous King!

3d. Her. Most noble King! Thanks, thanks!

1st. Her. The great gods bless you!

4th. Her. O you have saved us all!

5th. Her. How may we speak our gratitude!

7th. Her. We waited but till that
Ill Herald went, to freely pour our hearts
Out to you, King Demophoon!

Dem. Enough,
Enough,—to much my good young friends!—'Tis but
Small service I've yet rendered you, but that
Was done most gladly!—Nay in truth how should I
Refuse to shield the sons of Hercules,
When I received his Mother and his daughter!
Your aged Grandam Alkmene, and your fair sister
Makaria, have been here my welcome guests,
Since they too fled your common persecutor,

6th. Her. How, our sweet sister!

1st. Her. What, Makaria here!

3d. Her. O and where is she?

5th. Her. And Alkmene our Grandam!

7th. Her. We knew not whither they had turned!

2nd. Her. Here, too,
With you, O King, saviour of all our race!

Adras. Freed from the irksome presence of our foe,

Receive my thanks, too, King Demophoon,
For your magnanimous, most kingly act;
—Though, not of them, no son to Hercules,
If sprung of blood as royal as their own,
I scarce may know whether the open palm
Of hospitality you offered them,
Also extends to me,—though it be true
That even as theirs, Jolaus is my good father,
That I have wandered long and come with them,
And all my fate is linked and bound with theirs,
With them I stand or fall!

Dem. With them you came,—
It is enough!—you, too, whoe'er you be,
Are welcome, noble youth, who for your own sake,
Appear full worthy of good will and friendship!
Some other hour of greater leisure, you
Shall tell me your tale, how you came to join
Your life with theirs.—Now must I speedily off
So I prepare the town to meet the foe,
So close upon us, lest the Herald lied,—
To order sacrifice and to consult
The oracles and sages! (Exeunt *Dem.* and attendants.)

Jol. May the gods
Attend your every step, Demophoon,
Most worthy son of an immortal sire,
Our hope and help!—And thou, Almighty Jove,
In whose great name 'twas done, record this day
The golden deed, and lend thine aid to him
Who rushes heedless into cruel war
For the protection of poor fugitives!
(To the Cit's.) And to you, noble men of Athens. Friends
Without whose aid, without he felt assured
Of your consent, and generous approval,
Your king ne'er ventured this great enterprise,
Receive our gratitude!

(Re-enter one of the King's attendants.)

Att. The King has sent me
To pray you follow me into the Palace.

And there be lodged, craving your kindly pardon,
At the last moment, he bethought himself
No sooner of it!

Jol. Speak our thanks to him,
But say that we choose rather to rest here
Upon the Market-place, here at this altar
To pray for him and for the city's welfare,
Imploring the Immortals day and night,
Till his triumphant victory be assured!
Then, not till then, shall we most willingly
Refresh us 'neath his hospitable roof. (Exit *Att.*)

ANALYSIS OF PHYSICS,

TOGETHER WITH NOTES AND A LIST OF HAND AND REFERENCE BOOKS.

IN view of the extended course of instruction in Physics now given in public schools, it has been thought desirable that a somewhat full analysis of the subject should be presented in convenient form for the use of teachers. The outline given below was worked out in connection with a course of oral lessons to the higher grades of a district school. It is hoped it may prove serviceable to private students as well as to teachers.

For the sake of greater clearness, two schemes are presented; the first indicating only the most general phases of the subject as considered theoretically; the second exhibiting somewhat in detail the outlines of the several divisions which appear when the subject is studied with reference to specific classes of phenomena.

A—GENERAL OUTLINE.

I.—MATTER.

A—*Nature:* (unknown.)

B—*States:* a–solid; b–liquid; c–gaseous; d–state of dissociation. (See note 1.)

C—*Properties:* a–extension; b–resistance; c–inertia; d–divisibility; e–elasticity, etc. (See note 3.)

II.—FORCE.

A—*Nature:* (unknown.)

B—*Classes:* a–attraction, the special phases of which are recognized as (1) gravitation, (2) cohesion, (3) adhesion, (4)

chemical affinity, (5) electrical and magnetic attraction, (see note 4); b–Repulsion, the special phases of which are recognized as (1) heat, (2) electrical and magnetic repulsion.

C—*Correlation of Forces.*

D—*Conservation (or Persistence) of Force.* (Distinction between "Force" and "Energy.")

III.—MOTION.

A—*In Mass.*

B—*Molecular.*

C—*Atomic.* (See note 2.)

B—SPECIFIC DIVISIONS.

I.—DYNAMICS. (See note 5.)

A—*Of Solids* (usually called "Mechanics"): a–statics, (1) equilibrium of bodies; b–kinetics, (1) composition of forces, (2) laws of motion, (3) machines—lever, wheel and axle, pulley, inclined plane, wedge, screw. (See note 6.)

B—*Of Liquids* (usually called "Hydrostatics"): a–Hydrostatics, (1) pressure of liquids, (2) specific gravity; b–Hydrokinetics, (1) "velocity of a jet of water=that of a body falling from height of orifice," (2) water-wheels, (3) hydraulic ram.

C—*Of Gases* (usually called "Pneumatics): (Gases represented by the air.) a–Aërostatics, (1) pressure of the atmosphere (study of *a*–barometer, *b*–air-pump, *c*–common suction-pump, *d*–forcing-pump, *e*–siphon); b–Aërokinetics, (1) windmills, (2) sailing-vessels. (See note 7.)

II.—VIBRATION.

A—*Of Solids:* a–rigid (as the pendulum); b–flexible (as springs and cords).

B—*Of Liquids:* a–production and propagation of waves; b–interference of waves, etc.

C—*Of Gases* (Represented by the air): a–Production and propagation of aërial waves; b–combination and interference of aërial waves; c–reflection, transmission and refraction of aërial waves.

D—*Of the "Ether":* a–Production and propagation of etherial waves; b–velocity, intensity and length of ethereal waves; c–reflection, transmission and refraction of ethereal waves. (See note 8.)

III.—EFFECTS OF VIBRATION.

A—*Sound:* a–Characteristics of musical sounds, (1) loudness (depending on *intensity* of vibrations); (2) pitch (depending on *frequency* of vibrations); (3) quality or "timbre" (depending on *complexity* of vibrations; or, upon the relations of the "overtones" to the "fundamental tone" of a note or "clang"); b–musical intervals and diatonic scale; c–limits of pitch (more accurately, limits of [human] sensibility to aërial vibrations). (See note 9.)

B—*Light:* a–Law of rectilinear propagation; b–law of intensity; c–reflection of light (study of mirrors); d–refraction of light, (1) laws of refraction, (2) study of lenses; (3) study of prisms; (4) color, *a*–cause of color in non-luminous bodies, *b*–the spectrum, *c*–spectrum analysis; e–polarization of light; f–optical instruments, (1) applications of the lens, *a*–microscope, *b*–telescope, *c*–magic lantern, *d*–camera obscura; (2) application of the prism (spectroscope); g–the eye in relation to vision (and color). (See note 10.)

C—*Heat:* a–Causes of heat,* (1) percussion, (2) compression, (3) friction, (4) chemical action, (5) electrical currents;

* Leading physicists now consider the continuance of the sun's heat as due to compression—the continued contracting of the mass. The heat is thought by many to have been originally due to percussion, the falling together of stellar masses which were thus reduced to vapor and from which the present solar system was at length evolved.

b–laws of (1) transmission, (2) reflection, (3) refraction; c–diffusion of heat, (1) by conduction, (2) by convection, (3) by radiation; d–expansion; e–thermometry; f–the steam engine. (See notes 10 and 12.)

D—*Electricity and Magnetism:* a–Magnetism, (1) natural magnets, (2) artificial magnets, (3) magnetic substances, (4) terrestrial magnetism; b–statical (frictional) electricity, (1) electrical machines, (2) electroscope, (3) conduction and insulation, (4) Leyden jar, (5) atmospheric electricity; c–kinetic (chemical) electricity, (1) voltaic element (cell) and battery, (2) effects of currents, *a*–physiological, *b*–luminous, *c*–calorific, *d*–chemical effects; d–electro-magnetism and electro-magnets; e–electro-magnetic machines, (1) electro-magnetic engine, (2) electro-magnetic telegraph. (See note 11.)

NOTES.

The foregoing outline presents the subject in what may be styled its "dogmatic" form. This is, however, not the real attitude of the science. At present a large proportion, in fact the fundamental parts, are considered as provisional, and the foremost investigators are pressing eagerly toward the solution of the deeper problems which are found to be involved. At first nature was studied with the mere observation of its manifest phenomena. There was abundant speculation but no experiment. Afterward, for a long period, there was experiment and the mere noting of results, speculation being left to the *meta*-physicians. At length out of experiment have arisen inquiries which can only be answered by the speculative reason, so that the true "physicist" of to-day is as much a "speculative" philosopher as is the professed metaphysician. Such importance indeed have these inquiries assumed of late, that to know somewhat of their character and whither they are tending is highly important, or rather

quite necessary, to the formation of a correct conception of the present state of the science. It is with the hope of affording some slight assistance in this direction that most of the following notes are appended. Some, however, it will be observed, are intended merely to explain certain points of theory as now understood. Reference is made by numbers to the notes from such parts of the analysis as indicate the points at which the several inquiries arise.

1. By "Dissociation" is meant the state of *complete separation of compound matter into its elementary constituents.* It is deemed a necessary corollary of the atomic theory.

2. Modern physicists make a distinction between "atom" and "molecule"; the former being considered by them as the ultimate (*chemical*) division of an element; the latter, as a single unit of a compound.* Thus a molecule of water consists of one atom of oxygen and two atoms of hydrogen; the molecule of hydrogen consisting of *two atoms* of hydrogen. Atomic motion is therefore to be distinguished form molecular motion.

3. Respecting the *properties* of matter it is to be observed, that "extension" belongs rather to space and constitutes the essential characteristic of space; while, as applied to matter, it is resolvable into "resistance," and resistance is *force.* So also elasticity, porosity, ductility, etc., are manifestly relations of force, while inertia (strangely enough styled, by Deschanel, the "Fundamental Principle of Physics,") is by definition a pure negative—the "*indifference* of matter to rest or motion." The properties of matter seem then to consist of nothing else than force and relations between forces; whence it is not so strange as at first appears that many philosophers

* Cooke defines molecules as the smallest particles of a substance in which its qualities inhere, or the smallest particles of a substance which can exist by themselves. The atom, he defines, as the smallest particle of matter capable of entering into chemical reactions.

have considered matter to be, in its ultimate analysis, resolvable into points of force rather than into "atoms."

4. In the consideration of Force arise such questions as the possibility of "action at a distance." According to the atomic theory the particles of matter — even of the densest solid—are never in actual contact. How then can two atoms, any more than two stars, attract or *pull* each other? Or, if we allow a medium, that medium must be *continuous*, thus making impossible the slightest approach of the bodies toward each other; for any pull of the two bodies toward each other would tend to compress the medium. But this could not be, since, being continuous, the medium must entirely fill the intervening space and the least compression would cause two or more particles to occupy the same space, contrary to one of the first axioms of the science. What then is attraction, and how is it possible?

5. In classifying the divisions of the subject, treating of the action of force through masses, terms are used in the foregoing analysis in accordance with the now growing custom among physicists. Logically the same terms should be (and are, measurably, in the more recent technical treatises,) applied as well to force acting through molecules and atoms; but until the doctrine of vibration, or the "undulatory theory," is more generally understood, it would seem well to allow it special prominence even at the risk of some inconsistency in terminology; especially in schemes like the present, where the chief object sought is clearness of comprehension on the part of young people.

The term *Dynamics* is used, as Thomson and Tait have expressed it, "in its true sense as the science which treats of the action of *force*, whether it maintains relative rest or produces acceleration of relative motion." This, as they remark, is in accordance with the "proprieties of language," as well

as the "example of the most logical writers." "The two corresponding divisions of Dynamics are thus conveniently entitled *Statics* and *Kinetics*."

I have, however, introduced the more usual terms, Mechanics, Hydrostatics and Pneumatics, as equivalent severally to Dynamics of Solids, of Liquids, and of Gases, according to Deschanel, who introduces in his classification no special distinction between the action of force, which produces relative rest, and that which produces acceleration of relative motion.

The classification given above will be found to correspond somewhat nearly to that in Norton's Natural Philosophy (now the text-book in the High School and reference book for the District Schools of St. Louis). Norton, however, uses the term Mechanics much in the sense here given to the term Dynamics, and where he has used the term Dynamics, the term Kinetics is here employed.

6. The traditional "six mechanical powers" are really (in principle) reducible to two: the wheel and axle as well as the pulley acting upon the principle of a lever (of the first class), a compound pulley being equivalent to a compound lever, and the wedge and screw being simply applications of the inclined plane.

7. All movement is due to the combined action of attraction and repulsion. At the surface of the earth every particle is strained towards the earth's centre with the whole attractive force (gravitation) of its entire mass: thus undoubtedly the spherical shape was first gained; thus certainly that shape is now maintained. But the spherical form could not have been assumed at the first had not repulsion (in the "form" of heat) held the particles asunder, so as to give them entire mobility. Witness, on the one hand, the still perfectly spherical form of the earth in so far as its surface is yet freely mobile (of course leaving out of account such mi-

nor disturbances as the tides and that caused by rotary velocity), and, on the other, the irregularity of the land's surface, due to progressive concentration of the mass after the formation of a rigid "crust," and the consequent continued crushing together of that crust in huge ridges (mountains) with more or less extended bases (table-lands and plains) projecting above the level of the still mobile portion (namely, the sea).

Dynamics, then, is the science which treats of the complex activity of directly antagonistic modes of force, and it is only through this antagonism or "contradiction" that a world is possible at all. So, too, the currents of the air and of the sea depend upon this contradiction; the unequal distribution of heat simply causing a difference of specific gravity, thus affording the *condition* upon which the fluid masses are actually set in motion by gravitative force. Even in the steam engine gravitation is not less important than heat; for the effectiveness of the engine is dependent directly upon the *momentum* of the "drive-wheel." But momentum is a product whose factors are *weight* and *velocity;* and weight is but another name for gravitation, the velocity being produced by the expansive force of heat. Thus every movement on the whole face of the earth (or other sphere) can be traced to the interaction of these two modes of force whose very antagonism is a necessary condition of the motion, life and harmony of the physical universe.

8. The "ether," it should be remembered, is the name given to a supposed all-pervading and highly elastic medium, the existence of which is now by most physicists thought to be necessary to, and therefore proven by, the known phenomena of heat and light, and probably electricity, as modes of vibratory motion. Then comes the suggestion (from such eminent physicists as Profs. Tait and Balfour Stewart) of the

possible connection of the ether with ordinary matter; which again raises the question, now coming to be seriously considered, whether we have really reached the ultimate (chemical) analysis of matter in the 63 (or 65) "elements." Spectrum analysis comes in with its strange hints and possible prophecies. Spectra of some of the more diffuse nebulæ show only lines of hydrogen; those of more condensed nebulæ show traces of several substances, while fully-rounded but still white-hot stars give a continuous spectrum like that of our sun or of any incandescent solid or liquid.* Generally speaking, the more diffuse the nebulæ the more simple the spectrum, while the more advanced toward solidification the more complex the spectrum. So that the question arises whether, after all, matter is not really homogenous—whether what seems the complexity of matter, the multiplicity of elements, is not really the *complexity of grouping* of the particles of *one simple element;* the complexity of grouping being due to, and, in such case, of course increasing with, the steadily-accumulating strain incident to the condensation of nebulous masses into stars and suns and their attendant spheres?

Placing this beside the at least plausible view that the properties of matter are properly forces or relations of force, and we get some faint glimpse of how very far we yet seem to be from any definite solution of the mystery we call "Matter."

9. Sound, aside from the mind, is merely a succession of waves set up in a "sonorous" body and propagated through the atmosphere. That these waves may produce in the mind that state of consciousness termed "hearing," the mind must possess an organ suited to receive and carry forward those waves. But such organ must necessarily have its limitations; that is, it can be "sensibly" affected only by vibrations of certain media, and only by such vibrations of

* Or even of a gas when subjected to very great pressure.

these as occur with a given degree of frequency and intensity. Investigations have shown that, as a matter of fact, the vibrations (waves) of the air must, in order to sensibly affect the human ear, occur with a frequency of not less than 16 nor more than 38,000 in a second.* Of course, there are vibrations of sonorous bodies and of the atmosphere that take place with far greater frequency than 38,000, as well as those of much less than 16 per second. In fact, for the vibrations, themselves, there is no absolute limit whatever. So that when we speak of the "limits of pitch" (in music) we mean merely the limits within which it is possible for our organs of hearing to be sensibly affected by aërial vibrations.

10. *So Heat and Light* are considered to be modes of vibratory motion; and when we study them as purely physical phenomena, we can, according to the now received theory, consider them no otherwise than as infinitesimal vibrations set up in the particles of matter and propagated at the rate of millions of millions per second through an infinite sea of "ether." These wavelets vary in frequency and in intensity, and are to be studied in these respects as waves of the air or of the sea are to be studied. But as, when the waves of the sea beat against us, we have sensations of touch; as when waves (of proper frequency and intensity) of the air beat against the ear we have a sensation of "hearing" which we name "sound;" so when certain classes of wavelets of ether beat against the surface of our bodies, we have the sensation of warmth or "heat," and when certain other classes of these wavelets beat against the nerves of the eye we have the sen-

* From a note in the July (1876) number of the *Popular Science Monthly*, it appears that Prof. Preyer of Jena has found "the minimum limit for the normal ear" to be "from 16 to 24 vibrations per minute" [second?] "and the maximum 41,000 vibrations."

sation of vision or "color" and we name the sensation "light."*

11. *With Electricity*, indeed, the case is not so simple. The phenomena here have a complexity and even a character of apparent fitfulness, which renders them especially difficult of explanation; and physicists are, accordingly, not so well agreed as to what the explanation should be. Professor Maxwell has, it would seem, in his recent work on "Electricity and Magnetism," made out a strong cumulative argument in favor of considering electricity along with heat and light as a mode of ethereal vibrations, and hence it is so classed in the foregoing analysis.

12. Respecting the modern doctrine of heat we may note a seeming contradiction of terms on the part of its expounders. Heat is perpetually referred to and described as a "mode of motion;" and yet it is as constantly styled a *force*. Indeed it is represented as the prime "form" of repulsion; and the "mechanical equivalent of heat" is now understood to have been ascertained with at least approximate precision. And not only so, the same seeming contradiction is now manifest in the discussion of Light; Professor Crooks having shown it also to be a force. Here, then, crops out the still unsolved problem of the relation between Force and Motion, just as previously we noted the questionings concerning the relation between Force and Matter. Do we not seem likely to arrive at length at the conviction that Matter, Force, and Motion are all only so many different phenomena, the interpenetrating phases, or the interchangable and forever interchanging modes of manifestation of a *Supreme Essence*, back of and above all,

* Hence music and color have no existence save in the mind. Externally there is only vibration of varying intensity and frequency. The glories of a summer evening's sky are not *there* in the sky, but exist only in the perceiving spirit in which they are awakened by the reception of the unequally refracted wavelets of intervening "ether."

which determines or "moves" all, and which, in determining "all," determines itself? But such a Supreme Essence must be Mind or Intelligence. Hence it is Mind which constructs and governs the world. Such is the conclusion toward which the most eminent Natural Philosophers of to-day seem to be leading us. Such, too, has been the more or less distinctly expressed conclusion of the greatest thinkers in all ages—of Anaxagoras, of Plato, and of Aristotle, of Leibnitz, of Kant, and of Hegel. Once abroad in the wondrous world of Reason, men meet unexpectedly from seemingly opposite directions, and find that after all they are exploring the same lands and seas, and gazing into the same heavens.

LIST OF HAND AND REFERENCE BOOKS.

I. Concerning the whole subject and its various divisions, see the following hand-books:

(1) Cooley's Natural Philosophy, 1 vol., 12mo, pp. 315; especially valuable in respect of method; (2) Norton's Natural Philosophy, 1 vol., 12mo, pp, 468; (3) Ganot's Natural Philosophy, Atkinson's edition, 1 vol., 12mo. Either of these will be found a valuable guide, but for fuller information it is desirable to possess also one or other of the following more extended works:

(1) Deschanel's Natural Philosophy, Everett's edition, 1 vol., 8vo, pp. 1050, finely illustrated, with 737 plates; also bound in four parts; Part I., Mechanics, Hydrostatics, and Pneumatics; Part II., Heat; Part III., Electricity and Magnetism; Part IV., Sound and Light; (2) Guillemin's "Forces of Nature," Lockyer's edition, 1 vol., large 8vo; (3) Arnott's Elemets of Physics, 2 vols., 8vo. The last (eighth) edition of this work was published in 1866. Even this cannot be considered to accurately represent the present state of the science, but from the great number and aptness of the illustrative exam-

ples cited, it cannot fail to prove of great service to the discriminating teacher.

Deschanel will be found to be especially full and accurate. Guillemin is delightful reading, the style being remarkably clear and animated.

II. On the special phases of the subject:

A—Those who wish to familiarize themselves with the modern doctrine of Force should read, (1) the Essays which make up the volume, edited by Dr. Youmans, under the title Correlation and Conservation of Forces; (2) Faraday's Lectures (to young people) on the Various Forces of Nature; (3) Balfour Stewart's Conservation of Energy; (4) Helmholtz's Lectures (*a*) On the Conservation of Force, and (*b*) On the Interaction of Natural Forces (in volume of "Popular Lectures"); (5) Tait's Lectures on "Recent Advances in Physical Science."

B—On Dynamics of Solids, Liquids and Gases, the handbooks named are sufficiently full.

C—On Forms of Vibrations and Their Effects:

a–*Sound:* (1) Tyndall's Lectures on Sound; (2) Sedley Taylor's Science of Music; (3) Helmholtz's Lecture on the Physiological Cause of Harmony in Music (Popular Lectures). See also (4) Herbert Spencer's Essay on the Origin and Function of Music (in "Illustrations of Universal Progress"). (The latter can be said to belong to Physics only in so far as it illustrates the doctrine of "Rhythm of Motion," which is fully set forth in the chapter under that title in his "First Principles").

b–*Light:* (1) Tyndall's "Lectures in America;" (2) Helmholtz's Lectures on the Recent Progress of the Theory of Vision ("Popular Lectures);" (3) Lommel's Nature of Light; (4) Marion's Wonders of Optics (Library of Wonders); (5) Spottiswood's Polarization of Light; (6) Schellen's Spectrum

Analysis; (7) Roscoe's Spectrum Analysis; (8) Lockyer's The Spectroscope; (9) Lectures by Roscoe, Huggins and Lockyer on Spectrum Analysis in Half Hours with Modern Scientists, 2d Series.

Those specially interested in the theoretical phase of the subject will find profit in reading Goethe's Theory of Colors; Helmholtz's Lecture on Goethe's Scientific Researches; and a fine Essay on "The Music of Color," by C. E. Seth Smith, in *Journal of Speculative Philosophy*, Vol. 8, (July, 1874).

c–*Heat:* (1) Tyndall's Heat as a Mode of Motion; (2) Lectures in Tyndall's Fragments of Science; (*a*) On Radiation, (*b*) On Radiant Heat in Relation to the Color and Chemical Constitution of Bodies; (3) Cazin's Phenomena and Laws of Heat (Library of Wonders); (4) Clausius's Mechanical Theory of Heat; (5) Maxwell's Theory of Heat.

d–*Electricity and Magnetism:* (1) Tyndall's Lectures on Light and Electricity; (2) Tyndall's Elementary Lecture to Teachers on Magnetism (in Fragments of Science); (3) Tyndall's Lectures on Electricity in current volume of Popular Science Monthly; (4) Baile's Wonders of Electricity (Library of Wonders). The last named volume is devoted mainly to applications of electricity—the telegraph, electro-magnetic engine, electric light, etc.

Maxwell's Treatise on Electricity and Magnetism (2 vols., 8vo), is doubtless at present the chief authority among works in English, but can be of little service to those not familiar with the higher mathematics.

Respecting the supposed atomic structure and chemical characteristics of matter, much information may be obtained from J. P. Cooke's New Chemistry, while a brief but clear summary of the whole subject of "Chemical Physics," is given in Youman's Class Book of Chemistry, new edition,

1875 (Part I., pp. 13 to 126 inclusive). See also Part II. on "Chemical Principles."

Of course all the principal encyclopædias contain valuable articles on most of the topics named. Only those, however, that have been published, or have editions as late as, or later than, 1860, contain trustworthy information (if any at all) on the now received theory of the modes and effects of vibrations of elastic media.

It will be found of invaluable service to refer regularly to such scientific serials as *Nature* (weekly, London); the *Popular Science Monthly* (New York): and the *Popular Science Review* (monthly, London).

Lastly, of books descriptive of experiments and of simple apparatus there seems to be none satisfactory in English, though many valuable hints for the most elementary steps may be obtained from Cooley's "Easy Experiments in Physical Science," and from Balfour Stewart's little work on Physics (Science Primer Series). Those who read German will find Frick's Physikalische Technik (last edition, 1872) an excellent guide.

It is very much to be hoped that Dr. Curtman, whose delightful experimental lectures in physics are familiar to those interested in the subject in St. Louis, may soon find leisure to prepare the work which I understand he has for some time been contemplating on this highly important phase of the subject.

USE OF BIOGRAPHICAL SKETCHES.

That to fully comprehend a science it is necessary to know something of its history, is a generally recognized fact. Nor indeed does it need to be repeated here that the historical is at the same time one of the most interesting phases. This I have found to be epecially so with the children and young

people to whom I have given lessons. It has therefore seemed to me to be in keeping with the chief purpose of this paper to add, for convenience of reference to such books as Lippincott's Biographical Dictionary, Whewell's History of the Inductive Sciences, and Lewes's Biographical History of Philosophy, a list of names of some of those who, by their discoveries, either experimental or speculative, or both, have aided directly or indirectly in the development of the science of Physics. Of course no experienced teacher would need to be reminded that the biographical sketch of a discoverer should be entirely subordinated to and made to serve as an illustration of the discovery or discoveries immediately under discussion in connection with the regular work of the course; and that biographical sketches should be introduced into the science lesson for such purpose only. Many other names than those given might be added to the list, though it will, I think, be found that very few names of first importance have been omitted. We may begin the list with Thales of Miletus, and Heraclitus who were among the first of the Greeks to seriously attempt an explanation of Nature. The first considered Water, the second Fire, as the primeval element: next Leucippus and Democritus introduced a theory of atoms. Plato also presented a somewhat fantastic theory of Nature (see the Timaeus); Aristotle also presented a general theory; Pythagoras (before Plato and after Thales) made some experiments through which he discovered the numerical proportions of the musical scale. Of the others named above, none is reported to have performed experiments. They simply speculated on what they observed of the phenomena of Nature. (For accounts of the foregoing see also Ueberweg's History of Philosophy.)

With Archimedes, experiment began to be systematically employed. Lucretius advocated an atomic theory, still much

admired by many. (See Munro's Translation of his poem, *De Rerum Natura.*)

The following names are given without comment, the reason for their introduction being immediately apparent: Roger Bacon, Galileo, Lord Bacon, Torricelli, Huyghens, Newton, Fahrenheit, Franklin, Galvani, Priestly, Lavoisier, Laplace, Benjamin Thompson (Count Rumford), Dalton, Dr. Thomas Young, Ampere, Paschal, Davy, Fraunhofer, Fresnel, Sir J. Herschel, Faraday, Daguerre, J. W. Draper, Joule, and others, whose works are named in the list of hand and reference books.

Several of the names given, as Dalton, Priestly and Lavoisier, belong strictly to the history of Chemistry; but their investigations are so intimately connected with and throw so much light upon important phases of the science of physics as to fully warrant their introduction here, not to mention the essentially intimate connection of the two sciences. It will be observed too that no effort is made to classify the names beyond placing them in approximately chronological order.

WM. M. BRYANT.

NOTE.—Since completing this paper I have been fortunate enough to have an opportunity of examining a work just published and devoted to the "History of Natural Science." Its author, Arabella B. Buckley, was for some years private Secretary to Sir Charles Lyell. The book is a small 8vo of 467 pages. It is provided with a full index and with "Chronological Tables of the Rise and Progress of the Various Branches of Science." The style is clear and familiar, rendering it specially easy of comprehension and even thoroughly entertaining. It is, in short, a work to which every teacher of Natural Science (whatever the branch) ought to have access; and fortunately, the American Edition is in the market at the moderate retail price of two dollars.

SHAKESPEARIANA.

SHAKESPEARIANA FROM 1564 TO 1864 AND 1864 TO 1871. Franz Thimm. London: Franz Thimm. 1872.

This book is offered as "an account of the Shakespearian literature of England, Germany, France, and other European countries during three centuries," and is a valuable addition to any library.

It is doubtless known that there exists a Shakespeare Memorial Society, which aims to collect, at Birmingham, England, a library which shall include every book and tract that in any way belongs to a Shakespeariana. In the execution of this plan agents have been found among the scholars of all countries, and an endeavor has been made to make tributary the reading of all. Apart from the "Memorial" thus founded, we may expect in future bibliographies a completeness which will well repay any who have exerted themselves to aid the enterprise. Since, therefore, there is a reasonable prospect for perfecting a bibliography, it seems well worth while not only to call attention to Mr. Thimm's work, but to point out errors and omissions upon the assumption that they will be corrected in the next edition.

The English, German, and French Shakespeariana are all preceded by essays which set forth the progress of Shakespearian criticism. First after this essay on English Shakespeariana, comes a chronological list of the early Quarto Editions and the reprints of these; then a similar list of the Folio Editions, together with the values of the early editions and of original editions of the separate plays; next, a list of the Doubtful Plays, of the Poems, and of the chief Complete Editions. With these preliminary lists as a preface, the Shakes-

peariana begins and aims to give a complete list of Commentaries, Essays, and Plates. Then follows a list of Italian, Spanish, Portuguese, Danish, Swedish, Dutch, Friesic, Bohemian, Hungarian, Wallachian, Modern Greek, Polish, Russian and Bengalee translations: Shakespeariana is added in the case of the Danish, Dutch and Russian. The faults of this excellent undertaking are such as admit of an easy remedy, consisting of inaccuracies of abbreviation and capitalizing, the occasional mistake in the initials of a name, and the failure to specify the character of some of the works. While for most purposes a topical catalogue is more valuable, yet there are circumstances under which a catalogue by alphabetical title is most convenient: in both cases, however, wherever the title is not entirely characteristic of the book, there should be added an explanation. Generally Mr. Thimm has been careful in this respect, but he would do much toward perfecting his book if he would in all cases carry out this principle. For example, on p. 18, is the entry, "Addison—The Spectator, No. 40, 141, 279, 419." Upon making the reference one would find that No. 141 is not by Addison, and that the other references give us only allusions to Shakespeare—the addition of the word "allusion" would have saved the time and temper of the student. On p. 22 is the entry, "Blackwood's Edinburgh Magazine, V., pp. 217, 226"—it should be completed by an explanation of the reference. With these hints we may close remarks at all censorious and repeat a strong recommendation of the work to all book-buyers. Bohn's Loundes is more extensive; Allibone's Dictionary contains quite an extensive Shakespeariana: but neither of these books presents the subject with the twofold advantage of freedom from other matter, and reasonable cost.

As a contribution toward the improvement of the next edition, we add a list of Shakespeariana not to be found in Mr.

Thimm's book—partly because some of these appeared later than his last edition; and partly because the nature of his undertaking forbade perfection until after several editions had placed at his service the results of many readers.

Sir A. Alison's Essays, 1850–II–51, and III–104, 117, 123, 140, 423, 526. S. A. Allibone's Dictionary of Authors, II–2031. Isaac Ambrose's Cymbeline. M. Akenside, Inscription for a Monument to Shakespeare. American Quarterly Review, 18–485 (Review of Hazlitt's Characters.) 6–22. Alarum for London. American Journal of Education, Feb., 1873. American Literary Magazine. American Literary Gazette, Oct. 15, 1859, p. 374. American Publisher's Circular, 1850–374. American Whig Review, 121, 294 (Hudson, Character of Hamlet). American Bibliopolist, N. Y. Analectic Magazine, 5–68 (Hamlet's Character); 11–346 (Review of Hazlitt's Characters), *et aliter*. Aphorisms from Shakespeare. Archæologia, Archæologist. London Athenæum, 1848–937, 1033 (Chandos Portraits); 1844–1036 (Review of Hunter); 1846–469, 470; 1852–840 (Review of Guizot); 1856–1299; 1857–501, 822; 1860–II–78; 1861–I–432, 467, 561; II–446, 511, 545, 619, 729, 845; 1862–I–465. Feb. 5, 1876 (Skeat's Plutarch). Atlantic Monthly, Oct., 1859; Sept. 1861, *et aliter*. A. Becket's Shakespeare Revised. Beauties of Shakespeare: London, Moxon. Biographia Britannica. J. H. Burton's Book-Hunter. Baker: Biographia Dramatica. Byron and Lady Blessington, in Lady Blessington's Conversations. Brougham's Men of Letters, Time of Geo. III. Boston Prize Poems, 1824. Rich'd Barnefeld's Poems in Divers Humors, p. 159 (allusion). Thos. Bancroft's Two Bookes of Epigrammes and Epitaphs, 1639. Edmund Burke's Sublime and Beautiful. Albert Barnes' Essays and Reviews, II–86, and Lectures on Evidences of Christianity. G. Burnet's History of His Own Times. Bell's Principles of Surgery, II–557. Bibl. Parriana, 522. British Quarterly Review, July, 1875

(Shakespeare's Character and Early Career), *et aliter*. Bentley's Quarterly Review, Oct., 1857. Bentley's Miscellany. Blackwood's Magazine, May, 1819 (by John Wilson) 46–449 (Feigned Madness of Hamlet); II–504; XXIV–585; XXXVII–236 (Character of Hamlet); XXXII–350 (Ghost of Hamlet), *et aliter*. Colman's The Sheep Shearing, a Dramatic Pastoral in 3 acts, taken from Shakespeare, London, 1777. Catalogue of all Books and Pamphlets, &c., relative to Shakespeare, 12mo, 1807. Lord Campbell's Chief Justices. Sir Aston Cokain's Proeludium to Browne's Plays (allusion) and on Drayton's Death, 1631 (allusion). S. T. Coleridge's Friend, Letters p. 244, and Literary Remains II–174. J. P. Collier's Coleridge's Seven Lectures on Shakespeare and Milton, 1856. Jeremy Collier's Short View of Immorality and Profaneness of English stage, 1698. Barry Cornwall's Preface to Works of Jonson. Earl of Carlyle's Tercentenary Address. Châteaubriande's English Literature. Henry Chettle's Kinde Hart's Dreame, 1593. Continental Monthly. Critical Review. Cornhill Magazine, Oct., 1867. Dictionary of Quotations from British Poets, Part I. Dibdin's Library Companion 817, and Remains 353. D'Israeli's Curiosities of Literature, Quarrels of Authors, Anecdotes of Literature, Amenities of Literature. John Dryden's Epistle to Sir Godfrey Kneller and his Progress of Poesie. Chas. Dicken's Uncommercial Traveller. Sir John Davies' Scourge of Folly, Dublin University Magazine, June, 1876 (an emendation), *et aliter*. Democratic Review. Eckermann's Conversations with Goethe, I–114. R. W. Emerson's English Traits, Conduct of Life, Culture, The Over-Soul, and The Intellect. Edward Everett's Orations. Eclectic Review, Eclectic Magazine, 24–61, G. Gilfillan (Character of Hamlet); Nov., 1874 (Shylock), *et aliter*. Edinburgh Review, April, 1856; April, 1860; July, 1840–474 (Chronology); May, 1876 (Shakespeare and History); Aug., 1817, Jef-

frey; Aug., 1811, 7–420, 9–11, 13, 15, 16, 17–21, 22–34, Sir J. Macintosh; 24–449 (Douce's Edition); 26, 29, 31, 28–472, Jeffrey (Review Hazlett's Characters); 34–441, Talfourd (Character of Hamlet); 36–52, 445, 38, 42–3, 45, 47, 49, 51, 52, 54, 55, 59–64, 71, 73, 74, 76, 78, 81, 90–69 (Review of Ulrici), 103, 111. Edinburgh Monthly Review. C. C. Felton's Familiar Letters from Europe. Fraser's Magazine, Jan., Feb., May, 1860, 32–350 (Ghost of Hamlet), *et aliter*. Foreign Quarterly Review, II–697, *et aliter*. Florio, his First Fruits. John Foster's Life. Fortnightly Review, Dec., 1874 (Lear); May, 1875, and Jan., 1876, A. C. Swinburne (Three Stages of Shakespeare. Fleay's Shakespeare Manual, Macmillan & Co., 1876. Gibbon's Decline and Fall of Roman Empire, ch. 27 and 43, and Misc. Works, 420, 461. Goethe's Wilhelm Meister. G. Gascoign's Works. Gentleman's Magazine, 1812–II –344, 1826–I–421, 1856–II–60, 1840–II–35, (Autograph Signatures), I–39 (D'Israeli), 161, 374, 591 (J. Bruce), 369 (J. Hunter), 262 (F. Madden), 264, 470 (John Burgen), *et aliter*. Sir John Hales'. Hazlitt's Shakespeare Library. Histories and Tragedies published according to true original copies. Boothe's beautifully executed Facsimiles, 1864. Wm. Hazlitt's Lectures on English Poets, Lecture on English Comic Writers, Table Talk. Harcourt's Shakespeare's Argosy. Sir Wm. Hamilton's Lectures on Metaphysics, No. 33. Wm. Howitt's Visits to Remarkable Places, I–98. W. Carew Hazlitt's Handbook of Popular, Poetic, and Dramatic Literature of Great Britain, from Invention of Printing to the Restoration, 1868. Edward Hall's Union of the two Noble and Illustrious Families of Lancaster and York, 1548. J. O. Halliwell's First Sketch, 2d and 3d Parts Henry VI. Harper's New Monthly Magazine, 27–493 (Statesmanship), Sept., 1861, *et aliter*. Thos. Heywood's Hierarchy of the Blessed Angels. H. T.'s was Shakespeare a Lawyer? Die Hauptströmungen

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let, or Shakespeare's Philosophy of History. Moral Sentences from Works of Shakespeare compared with Sacred Passages drawn from Holy Writ: London, no date. James Montgomery's Lectures on English Literature. Sir James Mackintosh's Works. Tom Moore's Memoirs. John Milton's L'Allegro, and Epitaph in 2d Folio. T. B. Macaulay's Dryden. Mitford's Greece. Milton. D'Arblay. Principal Italian Writers. Moore's Byron and Croker's Boswell. Midsummer Night's Dream, illustrated with 24 fine Silhouettes, by P. Konewka: Longmans, 1868. Geo. P. Marsh's English Lang. and Lit., 569. Museum. Merchant of Venice, as produced at Winter Garden Theatre, Jan., 1867, by E. Boothe: N. Y., C. Alvord. Monthly Review. Metropolitan Magazine. Might and Mirth of Literature: John Walker Vilant Macbeth: Harper & Bros., 1875. Macmillan's Magazine. John Nichols' Six Old Plays, 1779. Nichols' Literary Anecdotes and Illustrations of Literature. North British Review, 1850 (Review of Guizot); 12–62 (Goethe as a Critic), *et aliter*. N. Y Tribune, Aug. 6, 27, 1859. New Monthly Magazine. North American Review, 19–253 (W. H. Prescott)); 35–168 (W. H. Prescott); 35–445 (A. H. Everett) *et aliter*. Oxford and Cambridge Magazine. John O'Leary's Catalogue of Pictures painted by Singleton. Henrietta Palmer's Stratford Gallery: D. Appleton & Co., N. Y., 1867. Pepy's Diary. Poynder's Literary Extracts. Poetical Works of Shakespeare and Surrey: Edinburgh, 1856. W. H. Prescott's Miscellanies. Alex. Pope's Imitations, Book 2, Epistle I. Phillips' Theatrum Poetarum Anglicanorum. Putnam's Magazine, Oct. and Nov., 1853, R. G. White. Quarterly Review, I–35, 87, 257, 273, II–372, III–179, 66, 435, IV–176, 506, 509, VI–187, 406, 462, VII–282, 331, 391, 445, VIII–111, 220, IX–111, 146, X–61, 134, 150, 302, 359, 362, 378, 382, 383, 528, XI–33, 37, 178, 401, 456, 189, 408, 483, 272, XII–132, 134, 136, 146, 509, XIII–39, 86, XIV–366, 474, XV–75, 126,

349, XVI–85, 212, 400, 437, XVII–251, 446, XVIII–158, 189, 464, XIX–127, 134, 211, 241, 296, 327, 430, XLVI–477, XLVII–243, XLIX–120, 181, 185, 187, XLI–70 (Macbeth), LI–461 (Ophelia), 41, 182, LIII–84, LIV–65, LXI–38, 428, 439, LXIV–348, LXV–355, 469, LXVI–24, 355, 469, LXIX–4, 31, 33, 70, LXX–62, LXXI–456, LXXIV–170, LXXXIX–310. J. Reynold's Dolamey's Primrose, 1606. Isaac Ray, Am. Journal of Insanity, II–537. Retrospective Review, Aug., 1854 (Singer's Jest Book), I–91, *et aliter*. Religious and Moral Sentences. Revue des Deux Mondes, 1876 (La Psychologie Médicale dans les Drames de Shakespeare), *et aliter*. James Rees' Shakespeare and the Bible: Phila., 1876. Ritson's English Anthology: London, 1793. R. Simpson's School of Shakespeare. Shakespeare Revised. Shakespeariana: Miscellaneous Essays and Criticisms, now first collected, 10 vols. Shakespeare's England: Longman's, 1856. Shakespeare Gallery, 100 Photographs from celebrated pictures by Reynolds, Opie, Northcote, Stothard, Fuseli, &c., 1867. R. Southey's Life and Colloquies, II–312. Sir Walter Scott's Life by Lockhart, and Encyclopædia Britannica. Edmund Spenser's Tears of the Muses, and Colin Clout's Come Home Again (allusions) Archbishop Sharpe. A. Scolaker's Return from Parnassus, 1606. Daiphantus, 1604, and Polimanteia, 1594. Southern Literary Messenger. Southern Review. S. W. Singer's Shakespeare's Jest Book. Alex. Schmidt's Shakespeare Lexicon: Berlin, Geo. Reimer. W. W. Skeat's Shakespeare's Plutarch. Scribner's Monthly Magazine, April, 1875 (Shakespeare-Bacon Controversy), E. O. Vaile; Sept., 1875 (Study of Portraits), *et aliter*. J. Horne Tooke's Diversions of Purley. Sharon Turner's History of England. French's Calderon, and his Tercentenary Sermon, April 23, 1864. Tieck's Letters on Shakespeare. H. T. Tuckerman's Month in England, George Ticknor's Spanish Literature. Taine's History of Eng. Lit. Tait's Magazine, The Gal-

axy, Turner's Pursuits of Literature. Univ. Review. Verstegern Restitution of Decayed Intelligence, 4to, 1605, p. 294, origin of name. Voltaire's Letter to the French Academy. Wm. Wordsworth's Memoirs, and Preface to Poetical Works. John Webster's Preface to White Devel, 1612. Horace Walpole's Letters, 6–394, 395, 7–135, 373, 8–160, 9–254. Whately's Bacon's Essays. Daniel Webster's Works 1–174. John Weever's Epigrammes. F. Winslow's Obscure Diseases of the Brain, 4–58. Westminster Review. Geo. Wilkes' Spirit of the Times, 1875. The St. Louis Western, 1873, 1875 and 1876. Richard Grant White's Authorship, 3 Pts., Henry VI. Dr. E. Young in Spence's Anecdotes.

For these additions we are indebted in part to Allibone's Dictionary of Authors, in part to Bohn's Loundes, and in part to private memoranda. The arrangement in the books mentioned is such as to have rendered inconvenient a presentation of all works there mentioned, and Mr. Thimm's alphabetical arrangement will be found a great improvement. If this article shall aid Mr. Thimm in perfecting his book, and if our readers will use it as auxiliary to Mr. Thimm's second edition, the time spent will not be in vain, and the writer will be the more readily excused for not making the list exhaustive, when it is understood that he willingly leaves bibliography to its regular professors and contents himself with a chance contribution.

H. H. MORGAN.

BOOK REVIEWS.

HAND-BOOK OF THE TERRESTRIAL GLOBE. By Ellen E. Fitz. Boston: Ginn Brothers. 1876.

Of the Globe, which this book is designed to accompany, judging from the description and illustration found in the volume, (our only means at hand,) it seems impossible to speak too favorably.

In a book, so clear in definitions, so well and fully illustrated, we were surprised to find an apple named as an example of a sphere. The instances in which an apple is sufficiently symmetrical to serve such a purpose are rare indeed; and the section made by cutting one from stem to blossom would give a very imperfect idea of a circle.

Again, in connection with the subjects of Nutation and Precession of the Equinoxes, it would be necessary to modify the statement made in article 65.

In all other respects the book is so complete that we pronounce it a worthy companion to the Globe.

Together, they ably treat the difficult subjects of seasons, and day and night, and well deserve a favorable reception.

L. S. RICHARDSON.

THE GERMAN ELEMENT IN THE WAR OF AMERICAN INDEPENDENCE. George W. Greene, LL.D. N. Y.: Hurd & Houghton. 1876.

This little volume of two hundred pages will have an interest for those who lack opportunity for continuous historical study, while at the same time they would wish to rescue from the realms of mythology the real factors of the American Revolution. The essays of Dr. Greene are but three in number and are severally entitled, Baron Von Steuben, General John De Kalb, and The German Mercenaries. The biographies of Steuben and De-Kalb are quite full and well-written and include both the personal and the military elements. Incidentally these essays bring out into distinctness the characteristics of Washington and of other leading men, and this service cannot be over-valued. Brilliant men are easily enabled to obtain the

rewards of desert; but well-balanced men always suffer from the fact that in symmetrical characters there is no single quality to fasten the attention; it is, therefore, only by long familiarity that we realize the real greatness of their power and work. Apart from the natural disposition towards idolizing eminent men, (towards an exaggerated enthusiasm which must be followed as a re-action, by indifference,) the heroes of our Revolution have suffered because of the lack of discrimination on the part of their eulogists. Amidst the variety of literary effort, there is still left ample room for some one to state popularly but accurately the grounds for a rational American patriotism. The necessity for this work must be apparent to all earnest students and the materials are now slowly being accumulated. Mr Greene's work independently of its direct claims, will be welcomed as a beginning in this direction. The work of the publishers has been done in the manner which they have led the public to expect, and they have furnished a convenient, inexpensive, and reliable edition.

EDITOR.

BIOGRAPHICAL CLUE TO LATIN LITERATURE. Edited after Dr. E. Hübner, with large additions by John E. B. Mayor, M. A., Professor of Latin in the University of Cambridge, and Fellow of St. John's College. London and Cambridge: Macmillan & Co. 1875.

This book contains complete lists of the works of all Latin authors, arranged in chronological order, with full indexes of editions and of the older English translations, embracing the whole range of Latin literature from the Lay of the Salii down to the era of the ecclesiastics, Bede and Boniface. It will prove a valuable aid to the classical student and will have a tendency to promote the study of Roman language by removing a serious obstacle to initial effort in that direction. Just such bibliographic help was a desideratum.

GEO. B. MACLELLAN.

SCRAPS OF INFORMATION; OR, A UNIVERSAL POCKET ENCYCLOPÆDIA. Robert S. Martin. Peoria, Ill.: Transcript Co. 1875.

In his preface Mr. Martin says: "As a business man, I have frequently, in the course of business or general conversation, had questions arise that I found it hard to answer. Many of these I could readily have answered when a boy at school." In these days of general education, all these little

manuals serve a useful purpose of which scholarly persons are generally unable to conceive. While we may regret that every one does not find it possible to be a profound general student, we should at the same time remember that intelligence is only relative, and that it is better for one to be as well informed as he may, rather than to cultivate a dense ignorance because he lacks opportunities for real research. It is true that "a little knowledge is a dangerous thing," but it is equally true that less knowledge is even more dangerous; conceit it is to be remembered is not the necessary consequence of a little knowledge but is the inherent quality of some temperaments and is equally consistent with knowledge and ignorance.

The contents of "Scraps of Information," are:

1. Population and Area of the Principal Countries of the World. 2. Population of Principal Cities. 3. Statistics of the States and Territories. 4. Votes for the President of the United States. 5. Scientific Terms. 6. Chronological Table. 7. Important Inventions. 8. Items in American History. 9. Historical Miscellany. 10. Tables of Weights and Measures. 11. Standards of Weights and Measures. 12. Estimates of Weights and Measures. 13. Rules for Mensuration. 14. Financial. 15. Money. 16. Curious Facts. 17. Comparisons. 18. Legal Notes. 19. Alphabetical Index.

The price of the book is fifty cents, and it will be found a convenience by such as need the aid of a ready-reference manual.

EDITOR.

NOTICEABLE ARTICLES IN MAGAZINES AND REVIEWS.

Popular Science Monthly—Sept. I. Voice in Man and in Animals. Chap. II. Emile Blanchard. II. On the Formation of Lakes. III. Industrial Application of Solar Heat. IV. The Revived Theory of Phlogiston.

Galaxy—Aug. I. Madcap Violet.

Macmillan's—July. I. Beethoven and His Works a Study. II. Quakers and Quakerism. III. Italian Art and Literature before Giotto and Dante. IV. The Faus Legend.

Aug. I. The Italian Drama. II. The Elder Hamlet. III. Correspondence between Schiller and the Duke of Schleswig-Holstein.

American Journal of Science and Arts—July. I. The Colorado Plateau Province as a Field for Geological Study.

Blackwood's—Aug. I. Domestic Yachting. II. Moliere. III. Calderon's Tragedies of Jealousy.

Edinburgh Review—July. I. The Growth of the German Naval Power. II. Ranke's History of England. III. The Letters and Works of Michael Angelo. IV. Mr. Swinburne's Erechtheus.

Journal of Science—Edited by Wm. Crookes, F. R. S. Aug. I. Vivisection. II. The Diamond in India.

Littell's Living Age—1677. I. Thoughts of an Outsider: International Prejudices (Cornhill Magazine). II. Quakers and Quakerism (Macmillan's).

1678. I. In a Studio, Part VIII (Blackwood's Magazine). II. The Last of the Grand School of the Connoisseurs (Temple Bar).

1679. I. Adam Smith as a Person (Fortnightly Review). II. In a Studio, Part IX (Blackwood's).

1680. I. Ticknor's Memoirs (Quarterly Review). II. Italian Art and Literature before Giotto and Dante (Macmillan's).

Fortnightly Review—July. I. Adam Smith as a Person. II. Political Machinery and Political Life. III. Past and Present. IV. On Some Disputed Points in Music.

Aug. I. Territorial Expansion of Russia. II. Robespierre. III. Hartmann's Philosophy of the Unconscious.

Fraser's—Aug. I. Russian Europe. II. The Extradition of Criminals. III. The French in Cochin China. IV. Education in Scotland.

Revue des Deux Mondes—Aout. I. La Philosophie des Causes Finales. II. Les Marins du XVI. Siécle. III. La Mission de L'Angleterre dans L'Inde, Progrés Moral et Matériél de la Colonie. IV. L'Empire des Tsars et les Russes.

W. J. S. Bryan.